

# Spread Spectrum Radio Modems

## Models RF400, RF410, RF415

Spread spectrum radios spread the normally narrowband information signal over a relatively wide band of frequencies. This allows the communications to be more immune to noise and interference from RF sources such as pagers, cellular phones and multipath.<sup>1</sup> The RF400-series modems reduce susceptibility to RF interference from other spread spectrum devices by providing user-selectable frequency hopping patterns.

The RF400-series spread spectrum radio modems support point-to-point and point-to-multipoint datalogger communications. They can serve as a field modem/radio while connected to the datalogger or as a base station modem/radio when connected to a computer. The RF400-series modems can also be used for general purpose wireless data communications.



### Features

- Individual FCC license not required<sup>2</sup>
- Up to one mile transmission range when using inexpensive omnidirectional antennas (shown). Up to 10 mile transmission range when using higher gain directional antennas at ideal conditions (please note that line-of-sight obstructions and RF interference will affect transmission distance)
- Low power consumption
- 9-pin CS I/O port that connects directly to the datalogger (no additional interface required)
- 9-pin RS-232 port that connects directly to a computer serial port or other RS-232 device
- 25-channel frequency-hopping radio
- Built-in simplified and advanced setup menus for configuring port modes, network/radio addresses, hop table, and power saving modes
- Setup that allows different addresses for multiple dataloggers in a point-to-multipoint network (call about repeater capability)
- Settings stored in non-volatile memory

1. The operating frequency band of these radio modems may be shared with other non-licensed services such as cordless telephones and with licensed services including emergency, broadcast, and air-traffic control.
2. RF400-series modems, like all FCC Part 15 devices, are not allowed to cause harmful interference to licensed radio communications and must accept any interference that they receive. Most Campbell Scientific users operate in open or remote locations where interference is unlikely. If there is a problem, interference can be reduced using methods such as moving the device, reorienting or using a different type of antenna, or adding RF shielding. We recommend the use of licensed UHF or VHF narrowband frequencies for critical communication links.



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## Ordering Information

**RF400** 900 MHz Spread Spectrum Radio/Modem (US/Canada)

**RF410** 922 MHz Spread Spectrum Radio/Modem (Australia/Israel)

**RF415** 2.4 GHz Spread Spectrum Radio/Modem (Worldwide)

Omnidirectional antennas are normally used at the base station and nearby stations. Yagi antennas are needed at distant stations or other special cases. Call one of our Applications Engineers for help in choosing an antenna. Only the following FCC approved antennas can be used.

### RF400 and RF410 antennas

#### 900 MHz, Indoor

- |       |  |
|-------|--|
| 14310 | 0 dBd, omnidirectional ¼ wave whip, straight 3.2". RPSMA connector connects directly to the radio; no antenna cable needed.                      |
| 14204 | 0 dBd, omnidirectional ½ wave whip, jointed, adjustable from 0° to 90°. RPSMA connector connects directly to radio; no antenna cable needed.     |
| 15970 | 1 dBd, dipole, window / wall mount. Supplied with a 10-foot RG-174 cable with an RPSMA connector.  |
| 15730 | 0 dBd, omnidirectional ¼ wave whip, right angle, adjustable from 0° to 90°. RPSMA connector connects directly to radio; no antenna cable needed. |
| 15731 | 0 dBd, omnidirectional ¼ wave whip, straight, 3". RPSMA connector connects directly to radio; no antenna cable needed.                           |



*The whip antennas (14310 shown) connect directly to the radio.*



*The 15970 has adhesive backing to allow it to adhere to a wall, rear-view mirror, or other suitable flat non-conductive surface.*

#### 900 MHz, Outdoor Omnidirectional

- |       |   |
|-------|---|
| 14203 | 3 dBd with cable clamp mounts. Has Type N female connector; requires an antenna cable to connect to radio.        |
| 14221 | 3 dBd with rugged FM2 antenna mounts. Has Type N female connector; requires an antenna cable to connect to radio. |



*The 14203 is suitable for base station use where it needs to communicate with multiple stations located in different directions.*

#### 900 MHz, Outdoor Yagi

- |       |   |
|-------|---|
| 14205 | 6 dBd, with mounts. Has Type N female connector; requires an antenna cable to connect to radio. |
| 14201 | 9 dBd, with mounts. Has Type N female connector; requires an antenna cable to connect to radio. |



*Yagi antennas (14201 shown) are intended for longer transmission distances.*

## RF415 antennas

### 2.4 GHz, Indoor Omnidirectional

- |       |   |
|-------|---|
| 16005 | 0 dBd, ½ wave whip articulating. RPSMA connector connects directly to radio; no antenna cable needed. |
|-------|---|

### 2.4 GHz, Outdoor Yagi

- |       |   |
|-------|---|
| 16755 | 13 dBd with mounts. Has Type N female connector; requires an antenna cable to connect to radio. |
|-------|---|



*The 16005 antenna has an articulating knuckle joint that can be oriented vertically or at right angles.*

## Antenna Cables and Surge Protectors for Outdoor Antennas

### Recommended for cable lengths <10 ft

- |              |   |
|--------------|---|
| COAX RPSMA-L | Low-loss RG58 antenna cable with reverse polarity, SMA connector and type N male connector. Specify length, in feet, after L. |
|--------------|---|

### Recommended for cable lengths >10 ft and/or use with lightning protection

- |            |  |
|------------|--|
| COAX NTN-L | Low-loss RG8 antenna cable with type N male to type N male connectors (requires 14462 or 16982). Specify length, in feet, after L. |
|------------|--|

- |       |  |
|-------|--|
| 14462 | Antenna surge protector kit for 900 MHz radios. Includes one COAX RPSMA-L1.5. Requires COAX NTN-L cable. |
|-------|--|

- |       |  |
|-------|--|
| 16982 | Antenna surge protector kit for 2.4 GHz radios. Includes one COAX RPSMA-L1.5. Requires COAX NTN-L cable. |
|-------|--|

### Additional accessories

- |       |                      |
|-------|----------------------|
| 14162 | Mounting bracket kit |
| 14291 | Optional power cable |



*For the 16755 Yagi antenna, the primary and secondary elements are enclosed in a white cylinder.*



*The purchase of an antenna cable (COAX RPSMA-L shown) is required for our outdoor antennas.*



*The surge protectors help protect the radios from electrical transients conducted through the antenna cable.*

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## Specifications

Operating Frequency:	910 to 918 MHz RF400, 920 to 928 MHz RF410, 2.450 to 2.460 GHz RF415
Type:	Frequency Hopping Spread Spectrum (FHSS) Transceiver
I/O Data Rate:	9600 bps
Channel Capacity:	65,000 Network Identifiers share 25 hop channels
Frequency Hopping Patterns:	Six different selectable patterns
Frequency Control:	Direct FM
Receiver Sensitivity:	-110 dBm (-104 dBm RF415) at $10^{-4}$ bit error rate (Campbell Scientific protocols will issue retries wherever a bit error occurs)
Interference Rejection:	70 dB at pager and cellular phone frequencies
Transmitter Power Output:	100 mW nominal (RF400, RF410) 60 mW nominal (RF415)
Antenna Connector:	Reverse polarity SMA
FCC ID:	OUR9XTREAM (RF400, RF410) OUR-24XSTREAM (RF415)
Operating Temperature Range:	-25° to +50°C standard (-55° to +85°C extended option for RF400, RF410 only; please note that the push button that allows customers to check/edit program-mable settings while the radio is connected to a computer may not operate at temperatures colder than -25°C)
Dimensions:	4.75 x 2.75 x 1.3 inches (12.1 cm x 7.0 cm x 3.3 cm)
Power:	9 to 16 Vdc
Average Current Drain:	<1 mA stand-by (assuming power-saving options used), 24 mA while receiving, <75 mA while transmitting (RF400, RF410) 36 mA while receiving, 75 mA while transmitting (RF415)
LEDs:	Power on, TX, RX, diagnostics
CS I/O Connector:	9-pin "D" Male for all needed communications lines. Newer loggers provide power to the radio on this connector. Older loggers may require optional power cable #14291*
RS-232 Connector:	9-pin "D" Female for TX, RX, CTS, ground RS-232 levels
Power Connector:	Barrel connector, center positive 12 V for use in base station configuration or with older dataloggers (newer loggers provide power to the radio on the CS I/O connector)
Compatible Devices:	21X(L), CR10(X)*, CR1000, CR200-series, CR23X, CR510, CR7, CR5000, CR500, RAD Modem, and COM200/COM210 (with A100/PS100 at a nondatalogger site)

*\*Older wiring panels (CR10 silver or CR10 black with gray terminal strips) will require optional power cable #14291.*



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